17th IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Post Mission Disposal and Space Debris Removal (1) (5)

Author: Prof. Zheng Hong Zhu
York University, Canada

DEMONSTRATION OF SPACE DEBRIS DEORBIT BY ELECTRODYNAMIC TETHER

Abstract

Electrodynamic space tethers (EDT) have unique capabilities to provide cost-effective mean to deorbit space debris or dysfunction satellites. This paper will provide details about a cubesat mission that is designed to demonstrate the space debris deorbit by electrodynamic tethers. The mission involves two 1U cubesatellites that are planned for launch from the International Space Station in Q4 2019, from where they will be inserted into orbit. One cubesatellite will host the EDT and its deployment mechanics. The other cubesatellite will host other secondary scientific payloads and pull EDT out of its storage. The EDT will be deployed with an initial velocity to pull the tether and then the resulting gravity gradient between cubesatellites will deploy the remainder of a 100-meter long aluminum tape-type EDT. The two cubesatellites communicate with each other with an intersatellite communication system for data transfer.

For launch and early operations, the two cubesatellites will be held together by a tensioned wire. They will not perform any operation for the first 30 minutes after ejection from the Station, to avoid any interference with ISS operations. After a link to ground has been established and initial housekeeping tasks are performed, the tensioned wire will be cut allowing the two cubesatellites to separate and deploy the EDT. The tether is attached to a Spindt array on one of the cubesatellite, which will be enabled post-tether-deployment to eject the collected electrons back into the plasma. This will generate a Lorentz force that will accelerate the deorbit of satellites. This paper highlights the mission concept study, mission design, nanosatellite design, hardware selection and testing, and operation.